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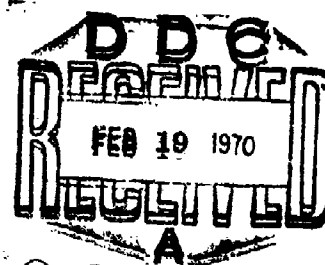
technical note

COLD WEATHER TRAIL AND LIVABILITY TEST OF  
MARK III VANIGAN.

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## INTRODUCTION

The Mark III wanigan was designed to provide complete messing and billeting facilities for a sled crew or a small group of men on detached duty. During the 1950-51 test season, the ease of erection and the suitability of the wanigan as mobile living quarters was determined at the Arctic Test Station. Based on the interim report written after the completion of this phase of the test, a revised list of collateral equipment was drawn up and a new interior layout was designed. The trials conducted during the 1951-52 season, which are discussed in this note, determined the suitability of the new collateral equipment and interior layout of the Mark III wanigan in providing satisfactory mobile living quarters.

The evaluation of the Mark III wanigan at the Arctic Test Station, Point Barrow, Alaska, was authorized by the Bureau of Yards and Docks under Project NY 013 02B-3.

## Description

The Mark III wanigan is composed of eight main sections, forming the roof, walls, floor, and the front and rear panels. The sections are held together by 3/8-inch-bolt panel connectors located on the top and bottom of the side sections. The completed wanigan is held together with four binding angles and vertical and horizontal tie rods. The complete wanigan is twenty-four feet long, ten feet wide, and eight feet high. The sections, fittings, and collateral equipment of the wanigan can be readily disassembled into small units to facilitate shipping. The collateral equipment consists of bunks; a mess table; a trailer-type space heater; a forced-draft cooking range; a combination electric, ice, and frozen-food refrigerator; clothes, food, and equipment storage lockers; a water storage drum; a galley sink; a head; an exhaust fan, and a complete electrical system. Photographs of collateral equipment are shown in Figures 1 and 2. Specifications of the equipment are described in the Appendix, and the floor plan is shown in Figure 3. The miscellaneous storage cabinet listed as optional equipment on the layout was not installed, as it was felt that the existing lockers provided sufficient storage space. The curtain shown in the layout as extending from the end of the mess table across the wanigan to the end of the double bunks was not installed, since the final report of last season recommended that such "partitions" were undesirable. The Arctic Test Station re-used the thermocouple strings that were left from the previous season's test work; these strings provided sixteen recording stations. Air currents within the

wanigan were measured at eight different stations after the anemometer was received in February.

The wanigan is assembled and mounted on an Arctic Type-I sled, which is twenty-four feet long and eight feet wide, two feet narrower than the completed wanigan. Brackets were fabricated and mounted on the sled to secure the wanigan. The sled "hold-downs" furnished were inadequate and were replaced the previous season at the Arctic Test Station with five lengths of 1/2-inch wire rope. Instrumentation for the tests consisted of a set of thermocouples to measure temperatures at various stations as shown in Figure 4, and an anemometer to record air movements within the wanigan.

#### Method of Evaluation

The Mark III wanigan was used for a number of livability tests at the ATS Base Camp and for a series of trail tests to determine the ruggedness of the equipment.

#### Evaluation of Mark III Wanigan

The testing program for the Mark III wanigan was divided into two parts: (1) a series of up to six livability tests of six-days duration each, during which the wanigan was to be used for berthing and messing of a four-man crew and (2) a series of seven short trail tests over various types of Arctic terrain, during which full use was to be made of all collateral equipment to determine its suitability on the trail.

#### Livability Tests

The first livability test was run from 22 October 1951 to 27 October 1951; ambient temperatures during that period averaged 23 degree Fahrenheit. Sample data are shown on the graph in Figure 5. The wanigan was stationed west of the field repair shop in a location totally unprotected from the weather, and a crew of four men were assigned to use the wanigan for messing, billeting, and the utilization of their leisure time that would ordinarily be spent in their quarters. In this way, the living conditions of a small group of men on detached duty was duplicated as closely as possible. All of the livability tests were conducted in this manner. The Onan 3-KW generator, the power source for the electrical system, broke down on the first day of this test; it was found that a main bushing had burned out. The generator was removed from the wanigan; and, for the remainder of the test, the camp power supply was used. The method of removing waste water from the galley sink by catch-

ing it in a large drum and periodically emptying this drum was found to be unduly cumbersome. Therefore, the drum was removed, and a 90-degree elbow was connected to the drain and passed out through the wall to deposit the waste water outside the wanigan. The mess table was too short to seat the entire four-man crew at one time; this deficiency was corrected by moving the two lockers together and extending the table by twelve inches. A twelve-inch fan, installed as an exhaust blower, proved to be very inefficient when used in this manner; and, at the completion of the test, it was removed and reversed, making it an intake blower. This change improved the ventilation of the wanigan. The refrigerator, cooking range, and space heater performed satisfactorily during this test.

The second livability test was run from 5 November 1951 to 10 November 1951; ambient temperatures during that period averaged 20 degree Fahrenheit. The Onan generator had been repaired and again was used as the power source for the electrical system at the beginning of this test. It was found that this generator caused excessive vibration of the entire wanigan; these vibrations were so severe that it was difficult to keep plates and silverware on the mess table, and the crew found it was almost impossible to sleep. This generator was removed and discarded for the subsequent tests. In its place, a Willys, 4-cylinder, 4-cycle generator, mounted on a Go-Devil sled and entirely enclosed in a frame shack which could be towed behind the wanigan was used. It was noticed during this test that the single step outside the doors was very inconvenient; the distance from the doorway to the ground was too great for just one step; and the present step also ices up with constant use and becomes dangerously slippery. The other collateral equipment performed satisfactorily during this test.

The third livability test was run from 19 November 1951 to 22 November 1951; ambient temperatures during that period averaged 18 degree Fahrenheit. The wanigan and all collateral equipment performed satisfactorily. During this test, it was found that the space-heater fuel drum could not be easily filled since there was no means provided for the mechanic to reach the drum inlet; to remedy this condition, a wooden ladder was built on the side of the wanigan adjacent to the fuel drum.

The fourth livability test was run from 11 December 1951 to 16 December 1951; during that period the ambient temperature averaged -14 degree Fahrenheit. The performance of all the collateral equipment was adequate, with the exception of the ventilation fan, which was considered to be too small.

### Trail Tests

The first trail test was run on 23 and 24 November 1951, when the wanigan was taken on a round trip to Avak in conjunction with the testing of the TD-24; the ambient temperature on those two days averaged 5 degree Fahrenheit. Avak is a well site about twelve miles from the Barrow camp. The trail to Avak was maintained by ArCon and was considered to be very smooth by Arctic standards. The wanigan was used by the four-man crew for messing and billeting on the overnight stop. The performance of all the collateral equipment was satisfactory; the only difficulty encountered was a leak in the cooking-range fuel line caused by a loose connection. This defect was readily repaired. A second trail test was made over this same trail on 6 December 1951; the average ambient temperature that day was -16 degree Fahrenheit. There was no overnight stop on this test; consequently, the wanigan was used only for the preparation of one meal during the turnaround at Avak. The operation of all collateral equipment was satisfactory with the exception of the galley-sink drain; the 90-degree pipe elbow that had been installed froze up during this test. After the test, the 90-degree elbow was replaced with a 45-degree elbow, and no further trouble was experienced.

The third and fourth trail tests were run from 18 December 1951 to 21 December 1951; the average ambient temperature was 3 degree Fahrenheit during that time. These tests were made over the ATS trail, which was about 13.5 miles long and was laid out over the tundra between the Barrow camp and the gas well. This trail was very rough, but it was felt that it was representative of the various types of terrain that are encountered by sled trains in the Arctic. The wanigan was taken to the end of the trail, where an overnight stop was made, and was returned to the base camp the following day. During the stopover, the four-man crew used the wanigan for messing and billeting. No difficulties were experienced with any of the collateral equipment. The wanigan body suffered slight damage during these two tests: the travel over the uneven terrain caused the wanigan panels to move, and several leaks developed in the bulkheads. These occurred around the rear door and around the ventilator over the lockers on the left bulkhead. Also, the rear wall of the head separated from the left exterior bulkhead. On 27 December, during a severe wind storm, a considerable amount of fine snow was blown into the wanigan through these openings.

The fifth and sixth trail tests were made in early January 1952; one on 2 January over the ATS trail, and the other on 11 January over the ArCon trail to Avak. On each trip, an

overnight stop was made, and the crew used the wanigan for messing and billeting. The average ambient temperatures during these tests was -20 degree Fahrenheit. In both cases, the trails were rough; however, the performance of the wanigan and its collateral equipment were satisfactory. There was some additional displacement of the exterior panels and the interior partitions; but, again, this displacement was not considered to be serious.

The seventh, and final, trail test was made on 17 February 1952, when the wanigan was taken on a short  $6\frac{1}{2}$  hour test-run over the ATS trail, with no overnight stop. One meal was prepared and eaten during this test, and the operation of all collateral equipment was adequate. The mattress on the lower bunk along the rear bulkhead caught fire while the wanigan was on the trail. The fire was caused when a cigarette thrown out the rear door blew back in unnoticed. Although this accident was due to outright carelessness, it should be pointed out that the mattresses are an unnecessary fire hazard; when the crew was billeted in the wanigan overnight, they used sleeping bags, rather than bedding; and the usual type of Navy mattress is not needed.

This trail run ended the test program on the Mark III wanigan; four livability tests and seven trail tests had been completed, and no major difficulties had been encountered with any of the collateral equipment or the wanigan.

#### CONCLUSIONS

It is concluded that:

1. The Mark III wanigan, with its present list of collateral equipment and interior layout, is entirely adequate and suitable for Arctic use. All the appliances and comforts necessary for satisfactory living quarters for men on detached duty in Arctic regions are provided.

2. The combination electric, ice, and frozen food refrigerator gave excellent service during these tests; its capacity is great enough to provide storage for all the perishable foods needed by a four-man crew for at least a week. The forced-draft cooking range was also adequate and dependable. The arrangement of the range, galley sink, and refrigerator was good, since it was very compact and made the handling of food and the preparation of meals as simple as possible. Only routine maintenance was necessary to keep this equipment in a satisfactory condition. It is felt that a pipe drain on the sink is a more expeditious method for the disposal of waste water than is the use

of a drum that has to be emptied frequently; with the 45-degree elbow in the pipe, there was no problem with frozen water plugging the drain. The mess table, having been extended from 60 inches to 72 inches, is adequate for the needs of a four-man crew.

3. The lockers built into the wanigan provided ample storage space for all gear, clothing, and dry food needed by the crew. It is felt that their present arrangement makes the best possible use of the available space. The trailer-type space heater proved to be very useful; it was compact and simple to operate and generated sufficient heat to warm the entire wanigan. No maintenance work or repairs were needed on this unit.

4. The two double bunks along the bulkheads proved adequate for the needs of a four-man crew. However, there is no need for the present spring and mattress arrangement; the mattresses are unnecessary and constitute a needless fire hazard. The men always use sleeping bags when billeted in the wanigan; and, if the mattresses were discarded and the springs were removed from the existing steel bedsteads and replaced with fire-resistant canvas, the comfort of this arrangement would be greatly improved.

5. The present fan is slightly small to provide adequate ventilation for the wanigan; it is felt that a more efficient ventilating system, although not absolutely necessary, would greatly add to the crew's comfort.

6. The method of carrying potable water in a 5-gallon thermos bottle and a 30-gallon uninsulated drum was satisfactory; but this water supply is deemed inadequate when the wanigan is used on an operational basis.

7. The existing electrical system is satisfactory as far as the size and location of all fixtures are concerned. The generator and its installation was found to be unsatisfactory.

#### RECOMMENDATIONS

It is recommended that the collateral equipment and the interior layout of the Mark III wanigan be approved for use as an interim standard, pending further wanigan developments, at advanced bases with the following changes or modifications:



1. A pipe drain with a 45-degree elbow be installed on the sink.
2. The mess table be increased to a length of 72 inches.
3. Fire-resistant canvas be installed in the bunks.
4. A larger fan, 18 inches, to be installed as an intake blower.
5. An 80 to 100-gallon drinking-water tank be installed inside the wanigan.
6. A toboggan-mounted 3 or 5 KW generator, Waukesha or equal, be supplied with wanigan.

It is further recommended that this project be closed and further investigations be carried under Project NY 013 02B-4.

COMMERCIAL COLLATERAL EQUIPMENT

MARK III WANIGAN

Cook Stove

Ingle Model No. P-114 CLC

Specifications:

The firebox and entire interior of this model have been designed to give maximum performance from the Kresky forced-draft burner. This is a fast, clean burner, selected after exhaustive tests.

Standard Equipment:

Full, polished, French top with grease trough; white enameled front door with oven thermometer; Kresky forced-draft burner (110 V - 60 cycle).

Dimensions:

Top plate, 21" x 32 $\frac{1}{2}$ "; over-all height to top plate, 31 $\frac{1}{2}$ "; oven, 14" x 12" x 17".

Will Serve:

6 to 8 persons per meal.

Fuel Consumption:

1/2 gallon per hour, maximum.

Shipping Weight:

275 lb

Net Weight:

225 lb

Ice Box

Marvel Model MR-1005D with left-hand swing door.

Combination Ice and Electric or straight electric refrigerator having a 5.6 cu. ft. capacity. Exterior finish - plastic unpregnated fibre board.

**Dimensions:**

25" wide; 20" deep; 44-11/16" high.

**Heater**

International Oil Burner Company Model NAC-41

**Specifications:**

Motor-Blower Unit - 110 volt, 60 cycle, A.C. current. Heavy duty, built to withstand rough, constant operation. Circulates a constant stream of warm air across the floor of the trailer. Entire Motor and blower unit can be quickly and easily slipped out of the bottom of cabinet for oiling or service, without removing stove from position in trailer.

Burner Unit - Patented pot type with latest oil atomizing feature. Burner can be turned high or low without smoke or carbonization.

**Heating Capacity:**

20,000 BTU heating units per hour.

**Heating Chamber:**

8 inches in diameter; 24 inches high; constructed of heavy rolled spot-welded iron.

**Oil Container:**

Heavy terne plate, approximately 2-1/5 gallon capacity.

**Oil:**

Burns regular Kerosene, No. 1 distillate, or No. 1 fuel oil. Very economical to operate.

**Valve:**

Automatic Constant-Level Safety Valve, approved by National Board of Fire Underwriters. Control lever at top of cabinet avoids stooping or bending to regulate heat. Electric Thermostat if desired.

**Cabinet:**

Streamlined construction with louvre top and open grill in front, for circulation of heated air. Cabinet is 12 inches wide by 16 inches deep and 36-3/8 inches high. It is finished in brown baked-on-enamel. Register in bottom of cabinet is adjustable to that, when motor and blower are operating, the heat can be directed across the floor to any part of the trailer desired.

Entire unit is furnished complete, ready to set in place and attach to 4-inch flue to operate. Shipping weight 65 lb.

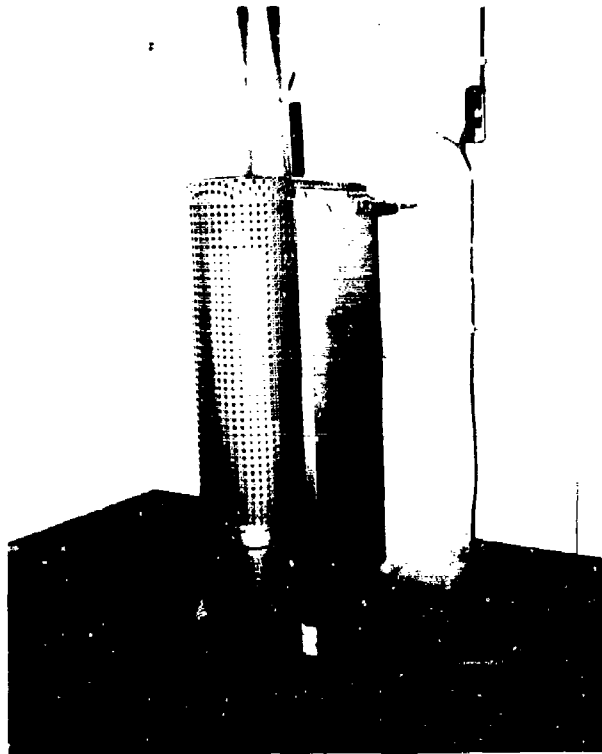


Figure 1 Collateral Equipment: Wanigan Stove

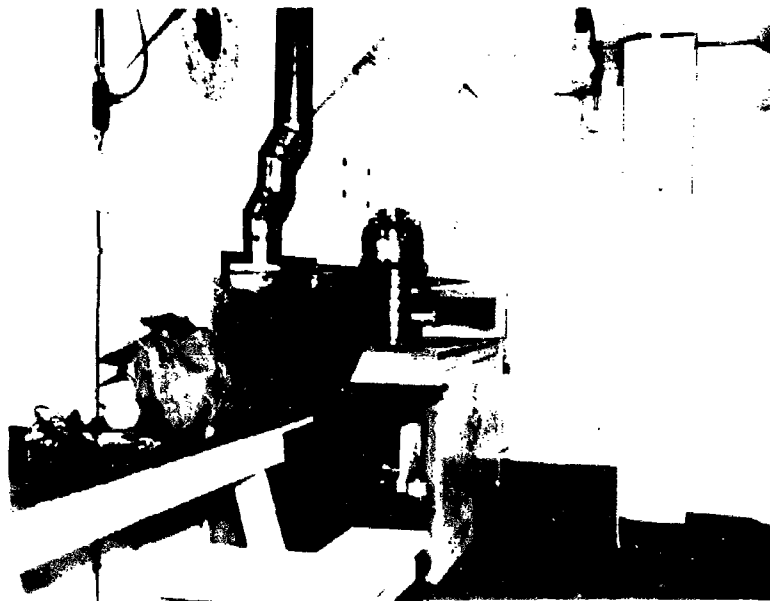
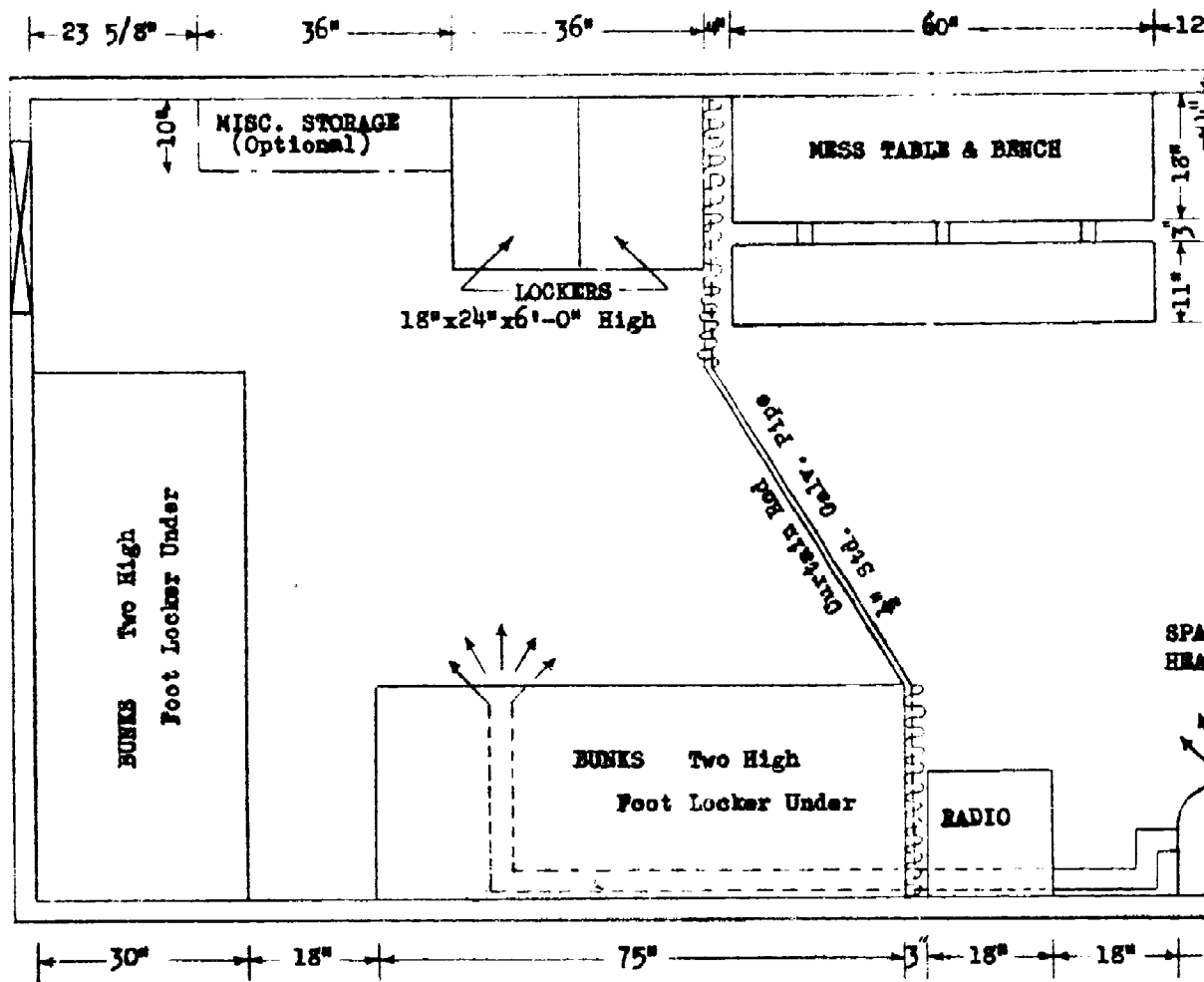


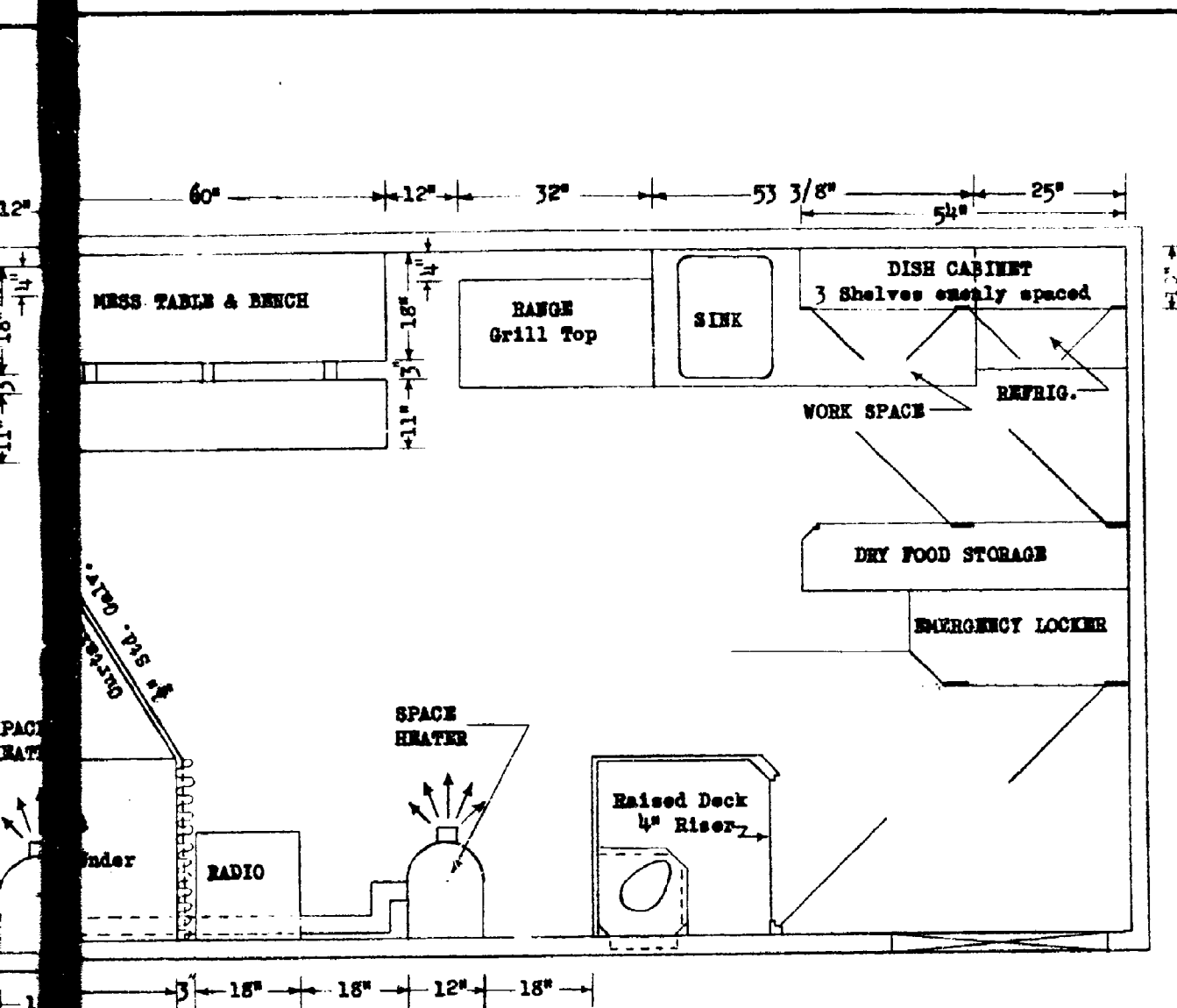
Figure 2 Collateral Equipment: Cook, Stove, Sink, Ice Box and Water Thermos Jugs.



**DIMENSIONS OF NEW EQUIPMENT:**

Cooking Range: 32" x 18" x 31 1/4" high  
 Refrigerator: 20" x 25" x 44 3/4" high  
 Space Heater: 12" x 16" x 36 3/2" high

Figure 3. General layout of the Mark



General layout of the Mark III Wanigan

BAREX 51  
TRAIL WANIGAN MK.III  
GENERAL LAYOUT

Drawn by:  
Checked by:  
Approved:

NAVCERELAB Sketch No. 534

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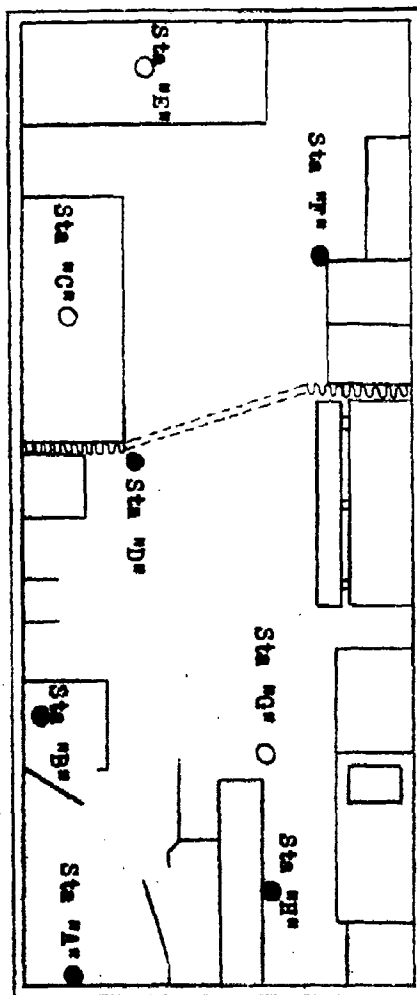
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Figure 1.

LOCATION OF TEMPERATURE AND AIR MOVEMENT STATIONS

**LEGEND**  
● Temperature Stations  
○ Air Movement Stations



SK. 535



Figure 5. TEMPERATURE DISTRIBUTION FROM FLOOR TO CEILING  
OF MK III MANICAN

